SECTION 8 - PORTFOLIO TRADEOFF ANALYSES

8.1 Introduction

As discussed in Section 7, the CVP IRP's approach for analysis of water manage-ment actions explored combinations of potential water management actions grouped into thematic portfolios designed to achieve particular objectives. Each portfolio was developed around a different suite of management actions and was analyzed by simulating the combined suite of actions with each of the 18 CVP IRP socioeconomic-climate scenarios to characterize its potential robustness against a wide range of future uncertainty.

The following five thematic portfolios were analyzed using the CVP IRP modeling tools:

- Portfolio A: Aggressive Local Actions
- Portfolio B: North-of-Delta Storage
- Portfolio C: Delta Conveyance and North-of-Delta Storage
- Portfolio D: Delta Conveyance and South-of-Delta Storage
- Portfolio E: Aggressive Local Actions, Enhanced Environmental Flows, and North-of-Delta Storage

The tradeoff analyses did not include Portfolio B because the actions included in Portfolio B were included in Portfolios C and E. Table 8-1 shows the individual water management actions included in the four simulated portfolios.

The following sections show how the portfolios were compared across the range of future socioeconomic-climate uncertainties to assess their performance relative to key metrics and to evaluate tradeoffs among them.

8.2 Reductions in Unmet Demands in the CVP Service Area

Figure 8-1 shows the average annual reductions in unmet demand in the CVP Service Area for each portfolio relative to the Baseline during the twenty-first century simulation period. Each of the four portfolios produced significant reductions in unmet demands across the entire range of socioeconomic-climate uncertainties. In general, reductions in unmet demands were greater for the drier Q1 and Q2 climate projections, and greatest under Expansive Growth (EG) and least under Slow Growth (SG). The aggressive local demand-reduction and supply-enhancement actions in

Table 8-1. Assumptions Included in the Final Simulation Suites in Each Portfolio

	Portfolio A	Portfolio C	Portfolio D	Portfolio E
Baseline Assumptions	x	x	x	x
Local Actions				
Modest Ag and M&I Conservation	x	x	x	x
Municipal Recycling and Desalination	x			x
Aggressive Ag and M&I Conservation	x			x
Systemwide Actions				
Delta Conveyance		x	x	
Shasta Lake Enlargement		x		x
North-of-Delta Offstream Storage		x		x
South-of-Delta SW or GW Storage			x	
Enhanced Environmental Flows				x

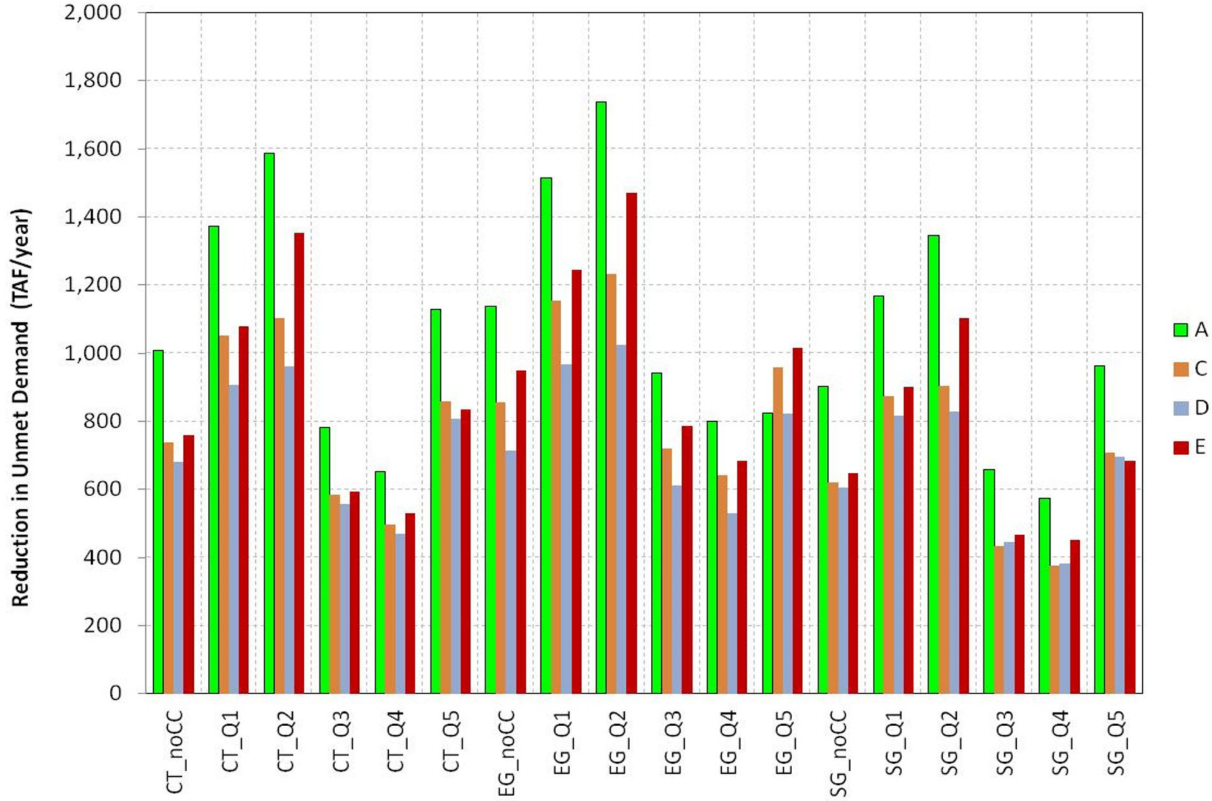

Figure 8-1. Average Annual Reduction in Unmet Demand in the CVP Service Area by Portfolio Relative to the Twenty-First Century Baseline Simulations

Portfolio A resulted in the greatest reductions in unmet demands among the portfolios. In contrast, Portfolios C and D only included modest demand-reduction actions and, therefore, had lesser reductions in unmet demands than Portfolios A and E despite greater increases in CVP deliveries relative to the twenty-first century projected Baseline.

Figure 8-2 shows the distribution of results for reduction in unmet demands in the CVP Service Area for each portfolio across the range of uncertainties represented by the 18 socioeconomic-climate scenarios and the average performance of each portfolio. Portfolio A had the greatest average reduction in unmet demand but also the greatest variability among the scenarios, indicating more uncertainty associated with achieving the higher potential demand reductions. By contrast, Portfolio D had the smallest average reduction in unmet demands but also the smallest variability across the scenarios, indicating less uncertainty in achieving potential demand reductions.

8.3 Delta Exports and Outflow

Figures 8-3 and 8-4 show the change in average annual Delta exports and Delta outflow for each portfolio relative to the twenty-first century Baseline simulations. Among the portfolios, the aggressive local demand management and supply-enhancement actions in Portfolio A resulted in a small increase in both Delta exports and Delta outflow relative to the Baseline. Combining enhanced environmental flows and North-of-Delta storage in Portfolio E with aggressive local actions resulted in an increase in Delta outflow and a reduction in Delta exports relative to the twenty-first century Baseline simulation. In contrast, both Portfolios C and D, which include Delta Conveyance, showed increases in Delta exports and reductions in Delta outflow relative to the Baseline.

Figures 8-5 and 8-6 show the distribution of results for change in total Delta exports and Delta outflow across the range of uncertainties represented by the 18 socioeconomic-climate scenarios and the average performance of each

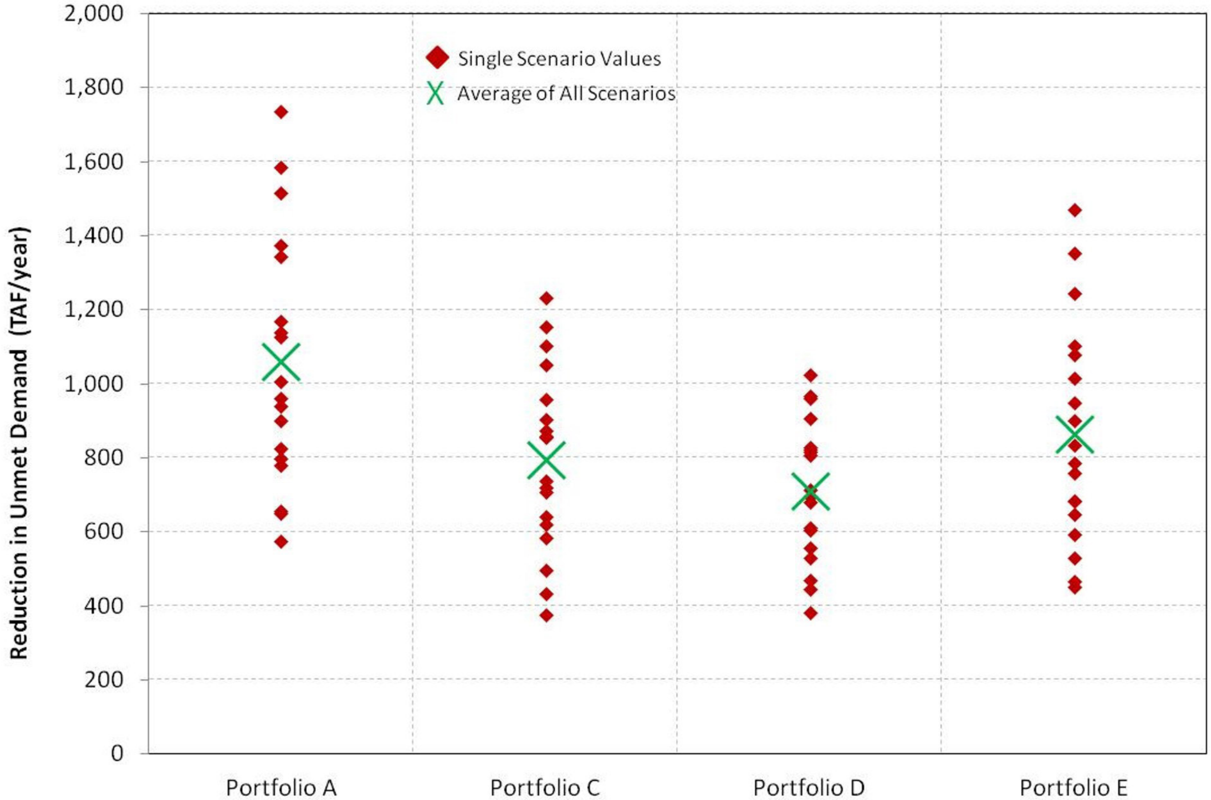

Figure 8-2. Distribution across Socioeconomic-Climate Scenarios of Average Annual Reduction in Unmet Demand in the CVP Service Area by Portfolio Relative to the Twenty-First Century Baseline Simulations

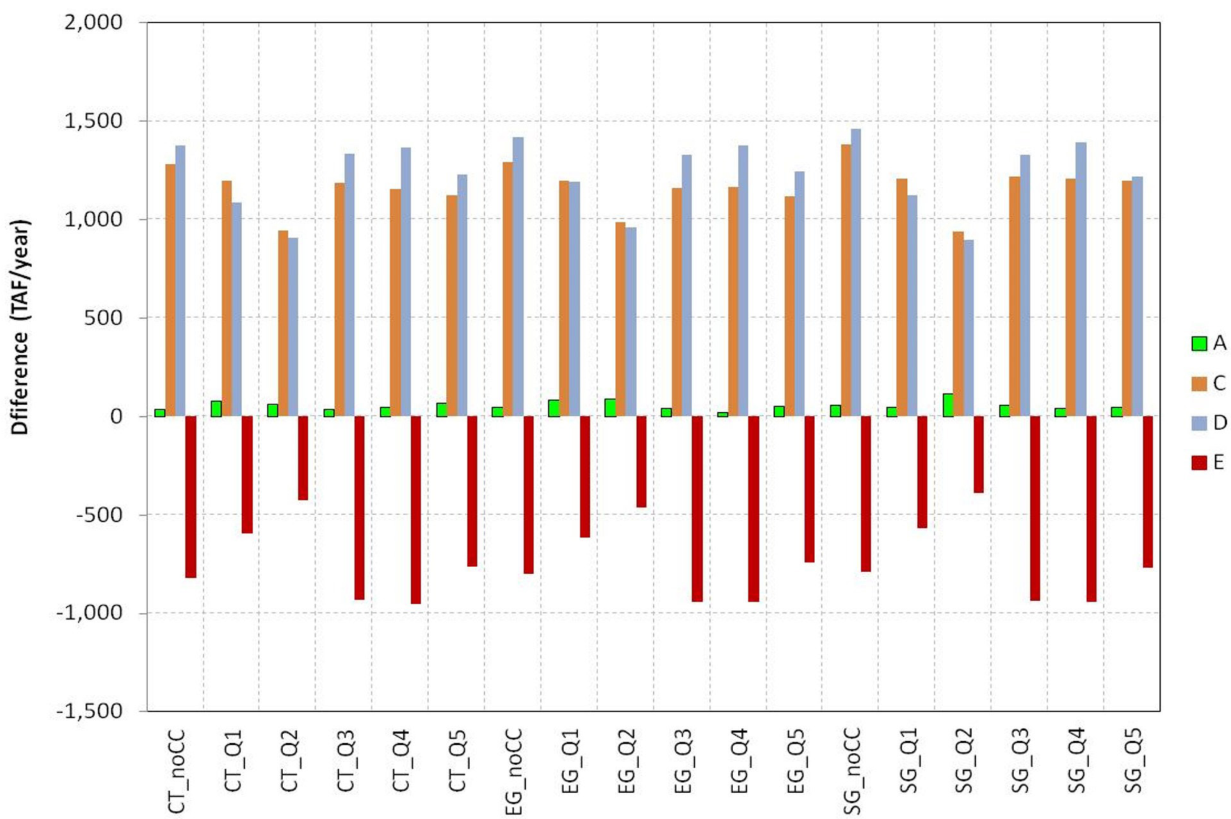

Figure 8-3. Distribution across Socioeconomic-Climate Scenarios of Average Annual Reduction in Unmet Demand in the CVP Service Area by Portfolio Relative to the Twenty-First Century Baseline Simulations

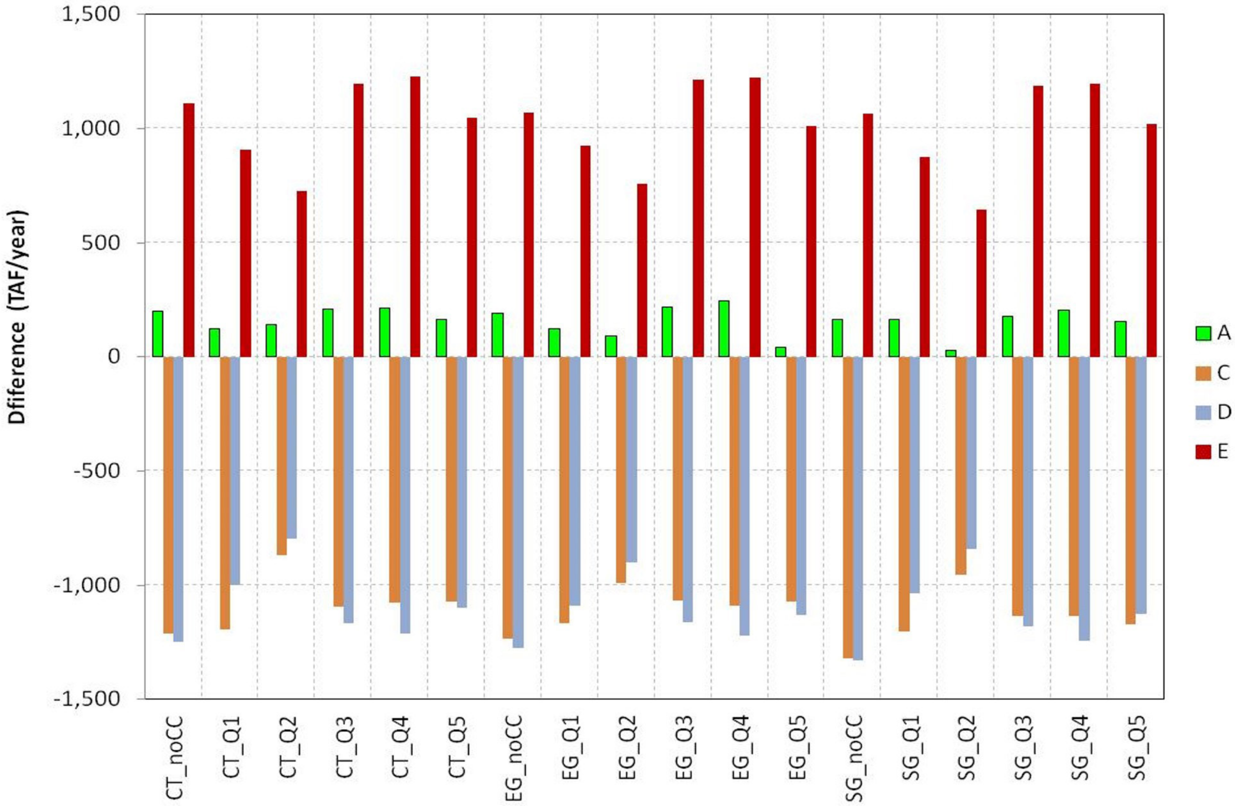

Figure 8-4. Average Annual Change in Delta Outflow by Portfolio Relative to the Twenty-First Century Baseline Simulations

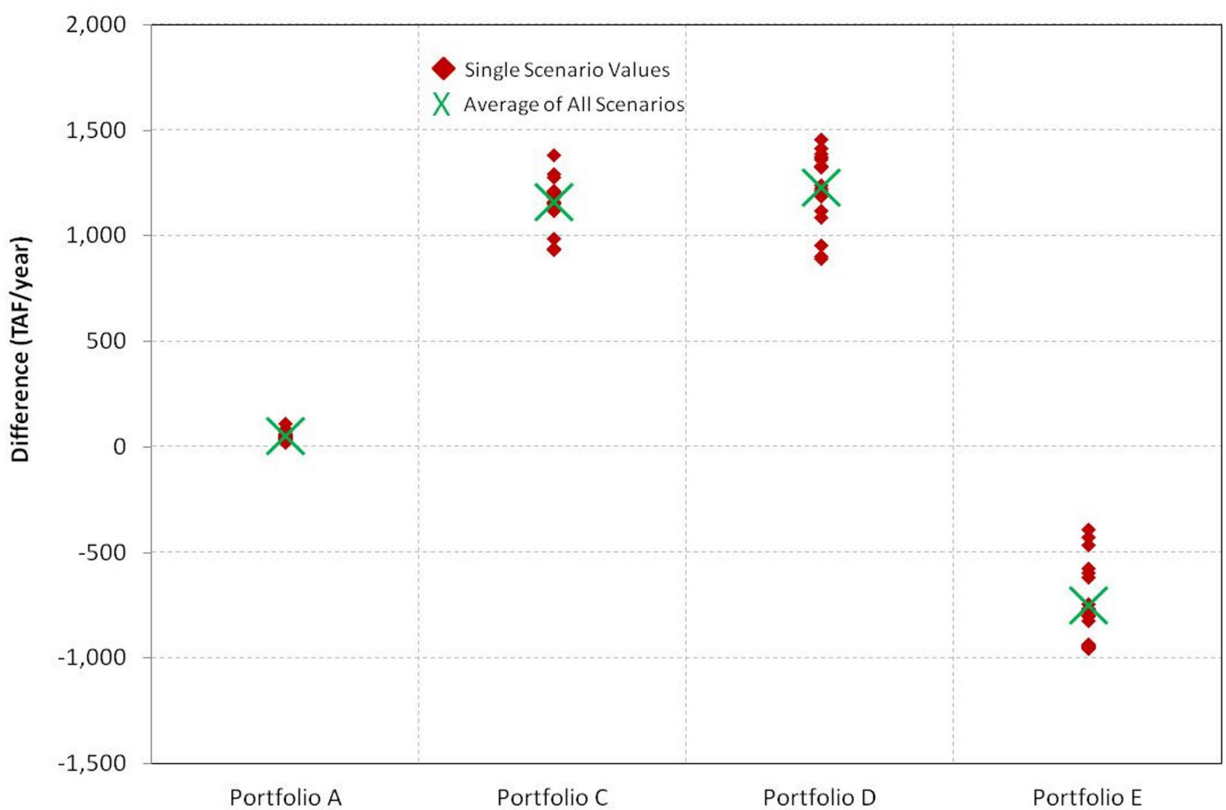

Figure 8-5. Distribution across Socioeconomic-Climate Scenarios of Average Annual Change in Total Delta Exports by Portfolio Relative to the Twenty-First Century Baseline Simulations

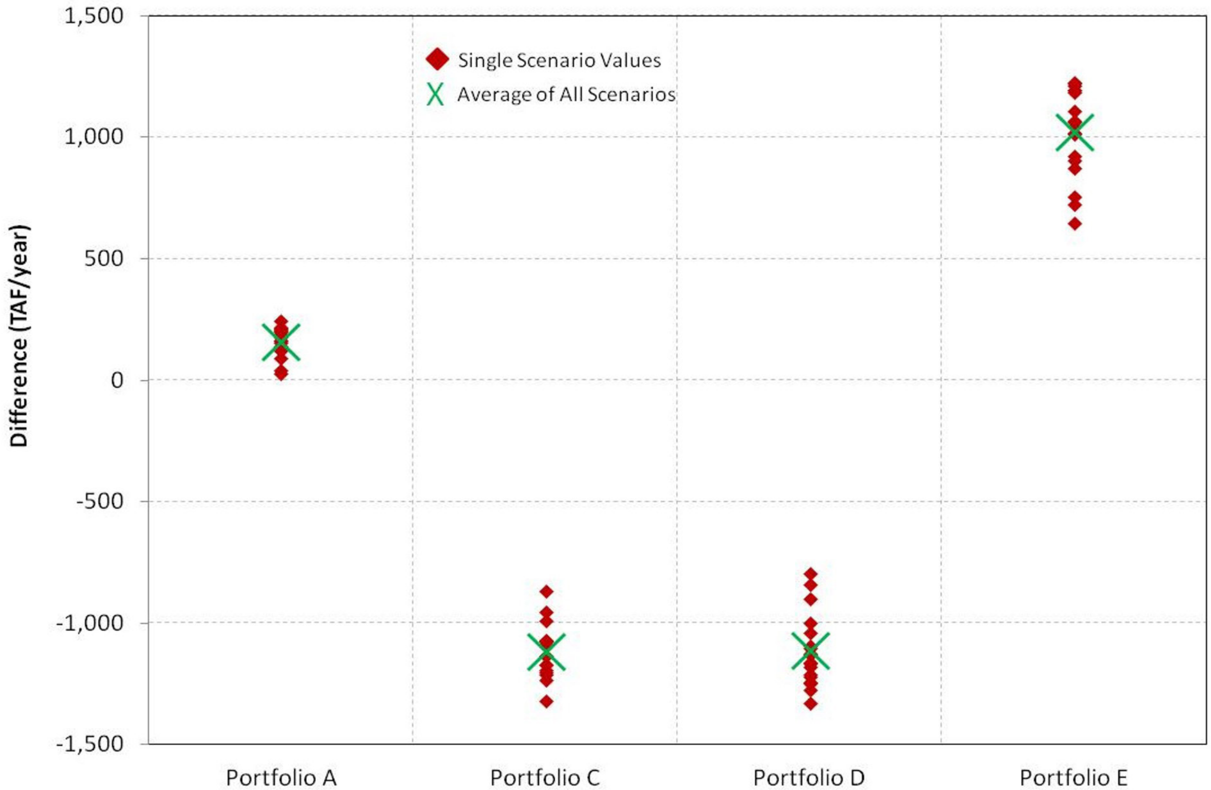

Figure 8-6. Distribution across Socioeconomic-Climate Scenarios of Average Annual Change in Delta Outflow by Portfolio Relative to the Twenty-First Century Baseline Simulations

portfolio. For both Delta exports and Delta outflow, the range of results was proportional to the average change from the Baseline. Portfolio A had the smallest changes in total Delta exports and Delta outflow, and the smallest range of uncertainties in results among the scenarios. The other portfolios had much larger differences relative to the Baseline and also larger ranges of results among the scenarios, indicating greater uncertainty in potential future changes in Delta exports and outflows.

8.4 Delta Salinity

Figure 8-7 shows the change in average X2 position from February through June for each portfolio relative to the twenty-first century Baseline simulations. Among the portfolios, implementation of aggressive local demand management and supply-enhancement actions in Portfolio A resulted in a very little change in X2 position. Adding Enhanced Environmental Flows and North-of-Delta Storage in addition to these local actions in Portfolio E resulted in a reduction in X2 position of about 2 to 3 km. In contrast, both Portfolios C and D, which include Delta Conveyance actions, showed increases in X2 position of about 1 to 2 km relative to the Baseline.

Figure 8-8 shows the distribution of results for change in X2 position for each portfolio across the range of uncertainties represented by the 18 socioeconomic-climate scenarios and the average performance of each portfolio. Portfolio E had the greatest average reduction in X2 position but also the greatest range of uncertainty in achieving these results. In contrast, Portfolios A and D had smaller ranges in X2 results among the socioeconomic-climate scenarios, indicating less uncertainty in potential future X2 position changes associated with these portfolios.

8.5 Water Temperature

Figures 8-9 and 8-10 show changes in mean daily water temperatures from July through September in the Sacramento River at Jelly's Ferry and from August through November in the San Joaquin

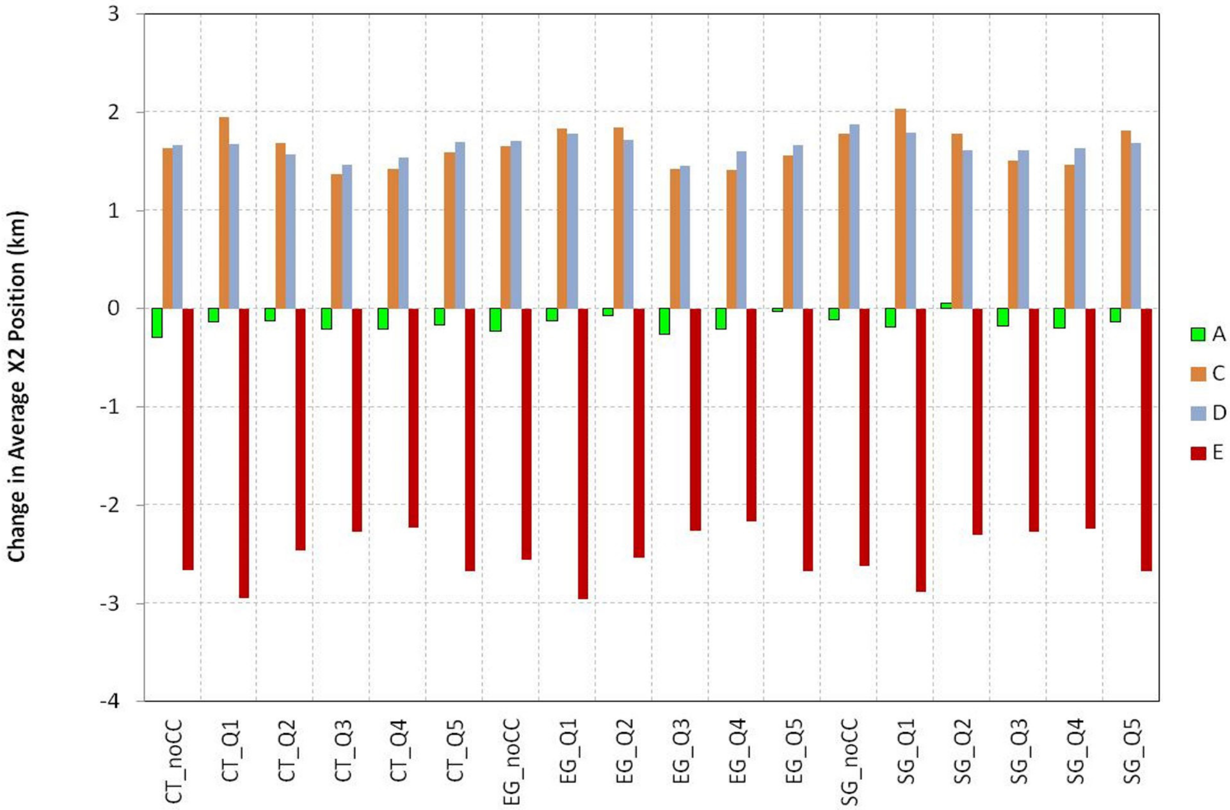

Figure 8-7. Average Annual Change in February-to-June X2 Position by Portfolio Relative to the Twenty First Century Baseline Simulations

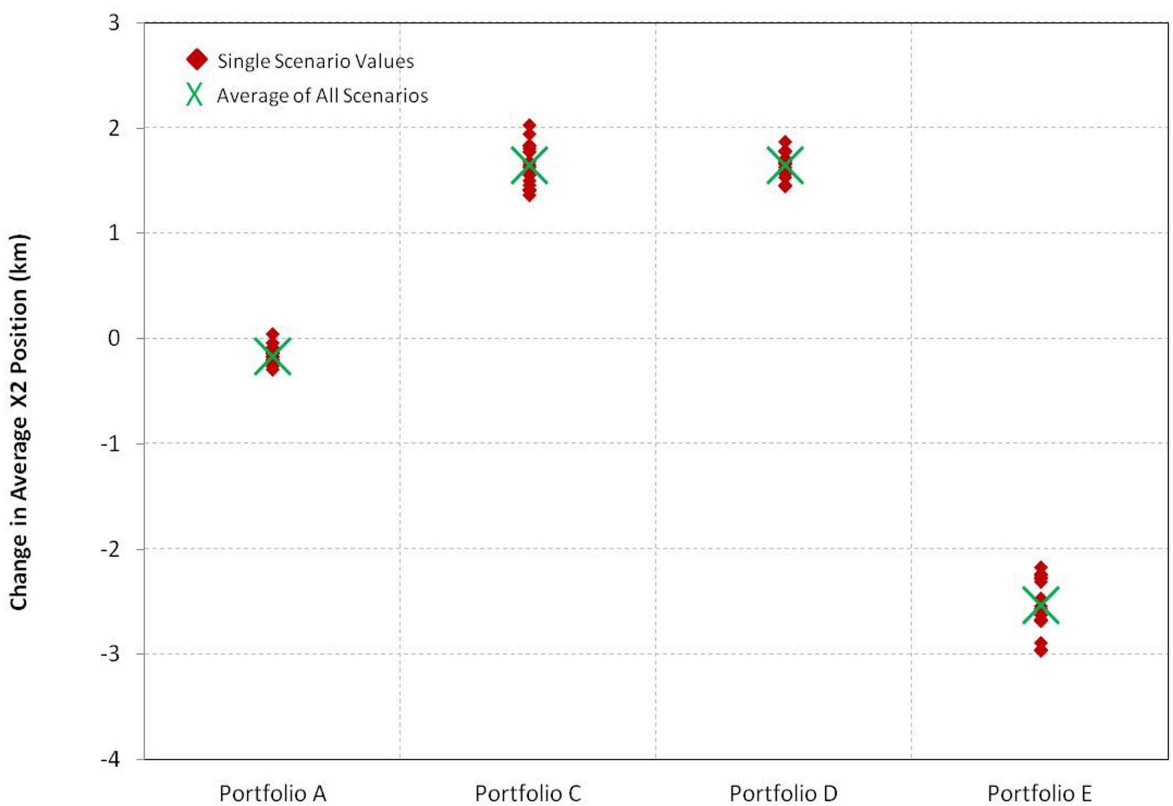

Figure 8-8. Distribution across Socioeconomic-Climate Scenarios of Average Annual Change in February-to-June X2 Position by Portfolio Relative to the Twenty-First Century Baseline Simulations

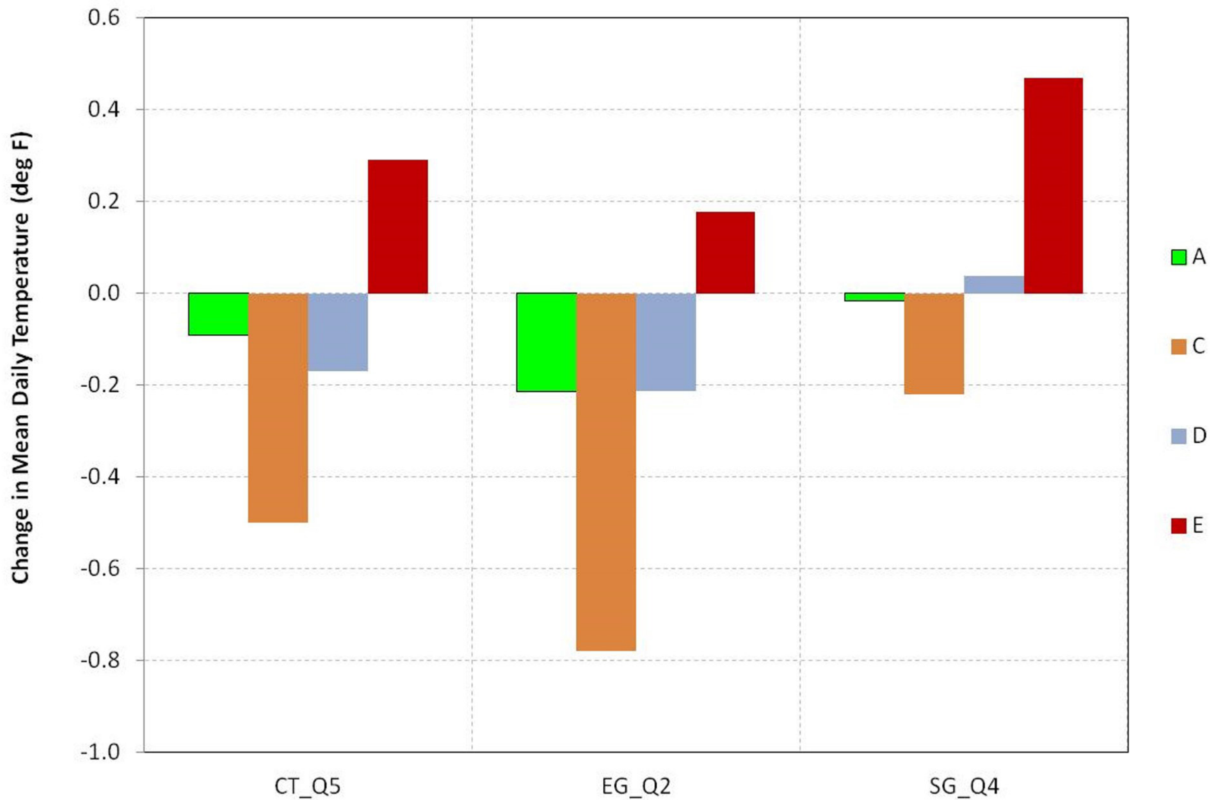

Figure 8-9. Changes in Mean Daily Water Temperature on Sacramento River at Jelly's Ferry from July to September by Portfolio Relative to the Twenty-First Century Baseline Simulations

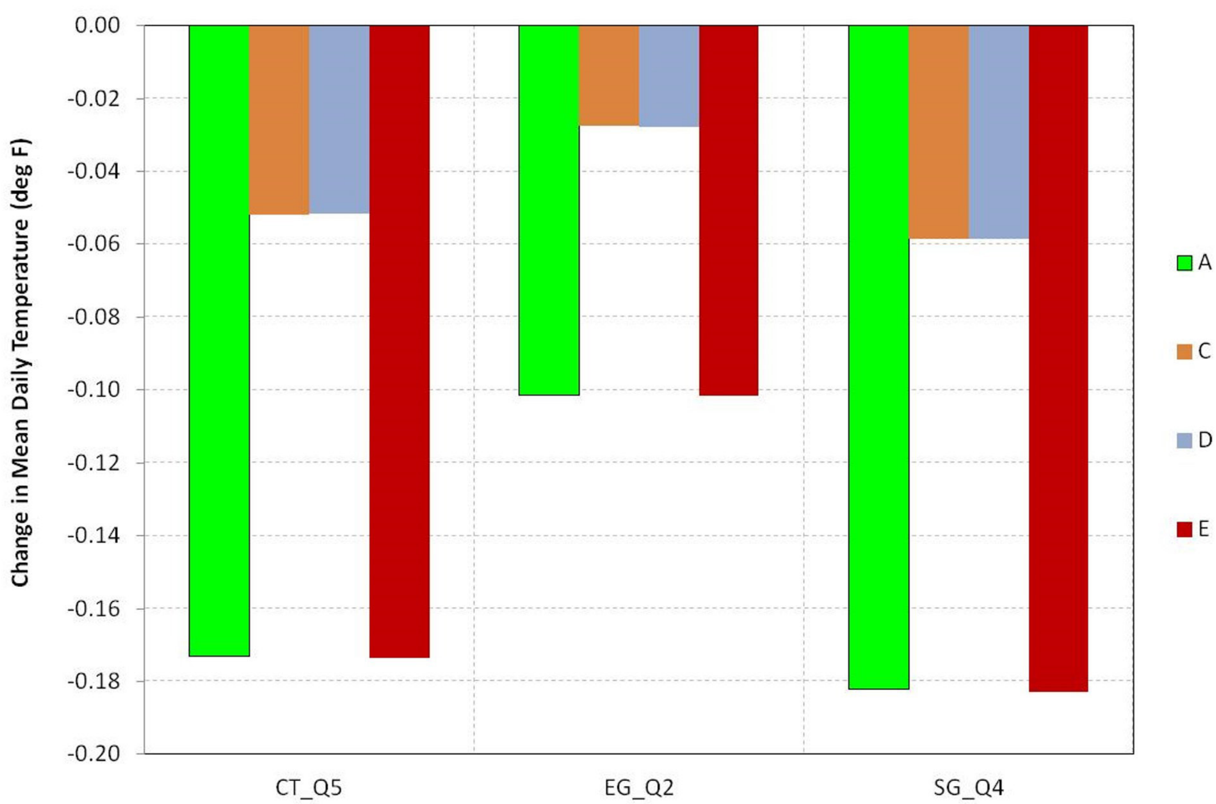

Figure 8-10. Changes in Mean Daily Water Temperature on San Joaquin River at Gravelly Ford from August to November in Each Portfolio Relative to the Twenty-First Century Baseline Simulations

River at Gravelly Ford for each portfolio relative to the twenty-first century Baseline simulations. The water temperature results were only computed for the Current Trends no climate change (CT-noCC), Expansive Growth – warmer and drier (EG-Q2), and Slow Growth – less warming and wetter (SG-Q4) scenarios. In the Sacramento River, the largest reductions in mean daily water temperatures ranging from 0.2 to 0.8°F occurred with the Delta Conveyance and North-of-Delta Storage actions in Portfolio C, where temperatures were reduced because of increased storage levels in Lake Shasta. In contrast, Lake Shasta storage levels were reduced with the Enhanced Environmental Flow actions (Portfolio E), resulting in small increases in water temperatures on the Sacramento River. On the San Joaquin River, small reductions in water temperature at Gravelly Ford occurred due to reductions in Friant diversions due to the demand reduction actions in all the portfolios.

Figures 8-11 and 8-12 show the distribution of water temperatures by portfolio for the CT-noCC, EG-Q2, and SG-Q4 socioeconomic-climate scenarios and their average values in 2025, 2055, and 2085. On the Sacramento River, the largest range in temperatures occurred in Portfolio C, which also had the largest average decrease in water temperature. On the San Joaquin River, all the scenarios resulted in very slight decreases in water temperatures with the range of uncertainties within the scenarios being less than 0.1°F.

8.6 Power Generation and Use, and Greenhouse Gas Emissions

Figures 8-13 and 8-14 show changes in average annual net hydropower generation or energy consumption and related GHG emissions (such as, increase in GHG emissions in the SWP system and reductions in potential GHG offsets in the CVP system) for the CVP and SWP systems for each portfolio relative to the twenty-first century Baseline simulations. Among the portfolios, the aggressive local demand management and supply-enhancement actions in Portfolio A resulted in small decreases in net power generation and corresponding small increases in GHG emissions relative to the Baseline. Both Portfolios C and D, which include Delta Conveyance, showed reductions in net power generation and increases in GHG emissions due to the increases in Delta export pumping. In contrast, Portfolio E with its Enhanced Environmental Flow actions showed increases in net power generation and reductions in GHG emissions due to the reductions in Delta export pumping.

Figures 8-15 and 8-16 show the range of changes in average annual net power generation and GHG emissions for the CVP and SWP systems across the range of future socioeconomic uncertainties represented by CT-noCC, EG-Q2, and SG-Q4 scenarios. The range of changes in Portfolios A, C, and D were small for both the CVP and SWP systems. However, the range of potential changes for Portfolio E was larger, indicating more uncertainty in potential future net power and GHG emissions.

8.7 Economics

The economic results were evaluated only for the CT-noCC, EG-Q2, and SG-Q4 socioeconomic-climate scenarios. Figure 8-17 shows the change in average annual net economic benefits in the CVP Service Area for each of the portfolios relative to the twenty-first century Baseline simulations in 2025, 2055, and 2085. These results reflect changes in urban water supply and salinity management costs and agricultural economic outputs throughout the CVP Service Area. These results are provided at three points in time to show the transient effects of changing socioeconomic conditions at different points in time during the twenty-first century. Both Portfolios C and D, which include Delta Conveyance, showed economic benefits relative to the Baseline, with the greatest benefits occurring near the end of the century in 2085 in the EG-Q2 scenario. The average annual net benefit in EG-Q2 was about $600 million/year in both of the Delta Conveyance portfolios (C and D) by 2085. In contrast, Portfolio E, which focused on Enhanced Environmental Flows, showed economic costs of up to $350 million/year by 2085 relative to the twenty-first century Baseline simulation.

Figure 8-18 shows the distribution of economic results in each portfolio across the range of uncertainties associated with the CT-noCC, EG-Q2, and SG-Q4 socioeconomic-climate scenarios and their average values in 2025, 2055, and 2085.

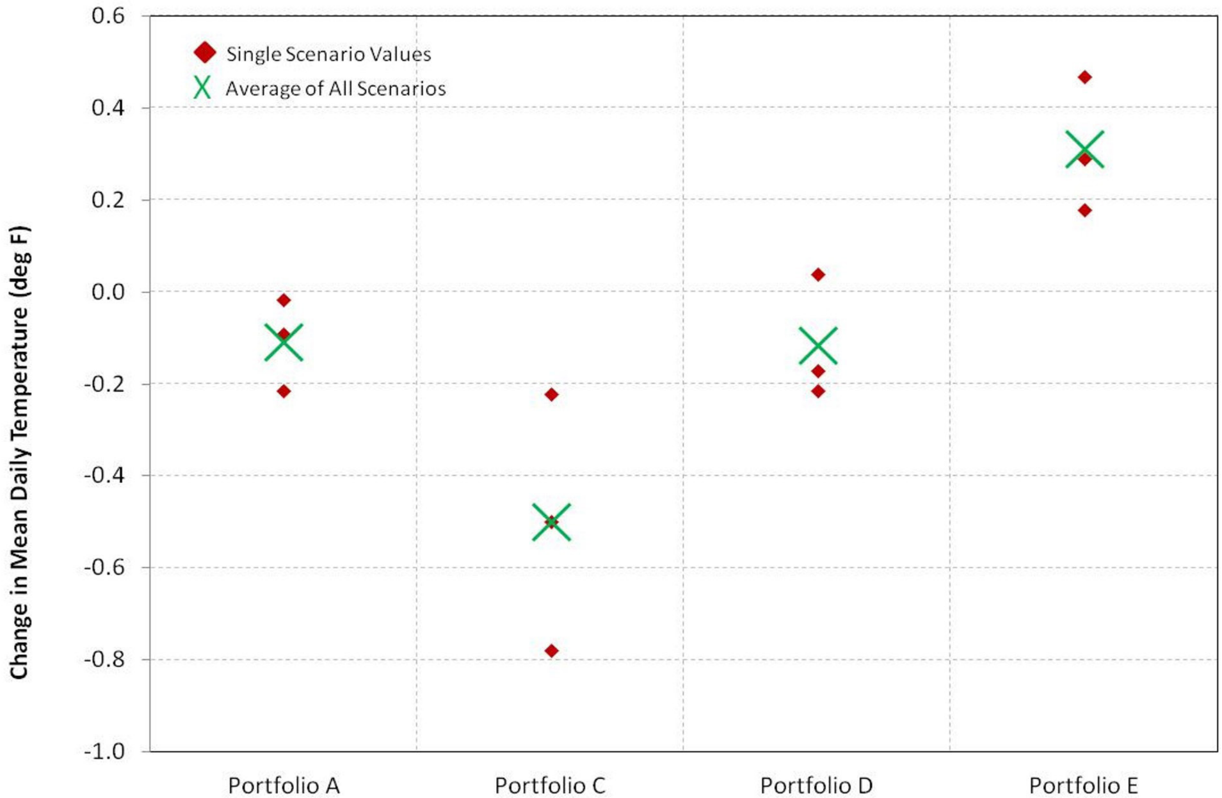

Figure 8-11. Distribution of Changes in Mean Daily Temperature in Sacramento River at Jelly's Ferry from July to September by Portfolio Relative to the Twenty-First Century Baseline Simulations

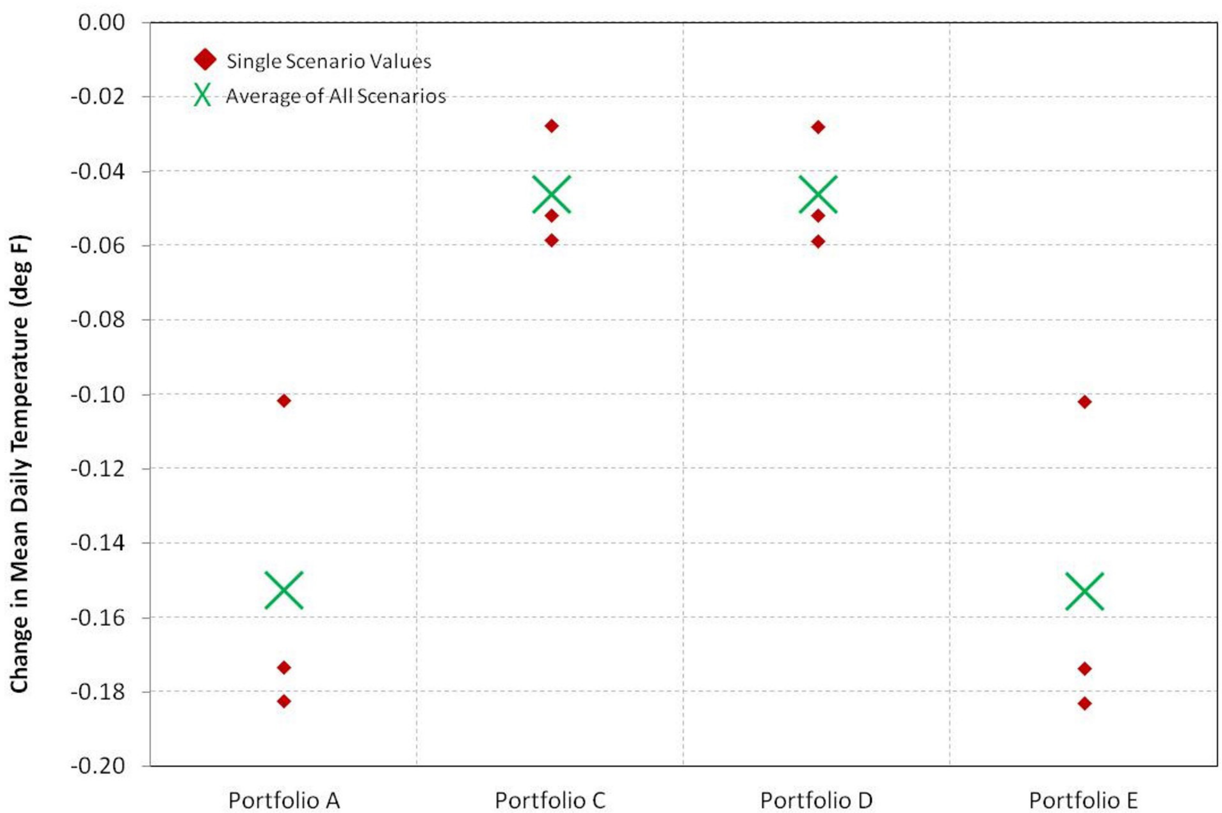

Figure 8-12. Distribution of Changes in Mean Daily Temperature in San Joaquin River at Gravelly Ford from August to November by Portfolio Relative to the Twenty-First Century Baseline Simulations

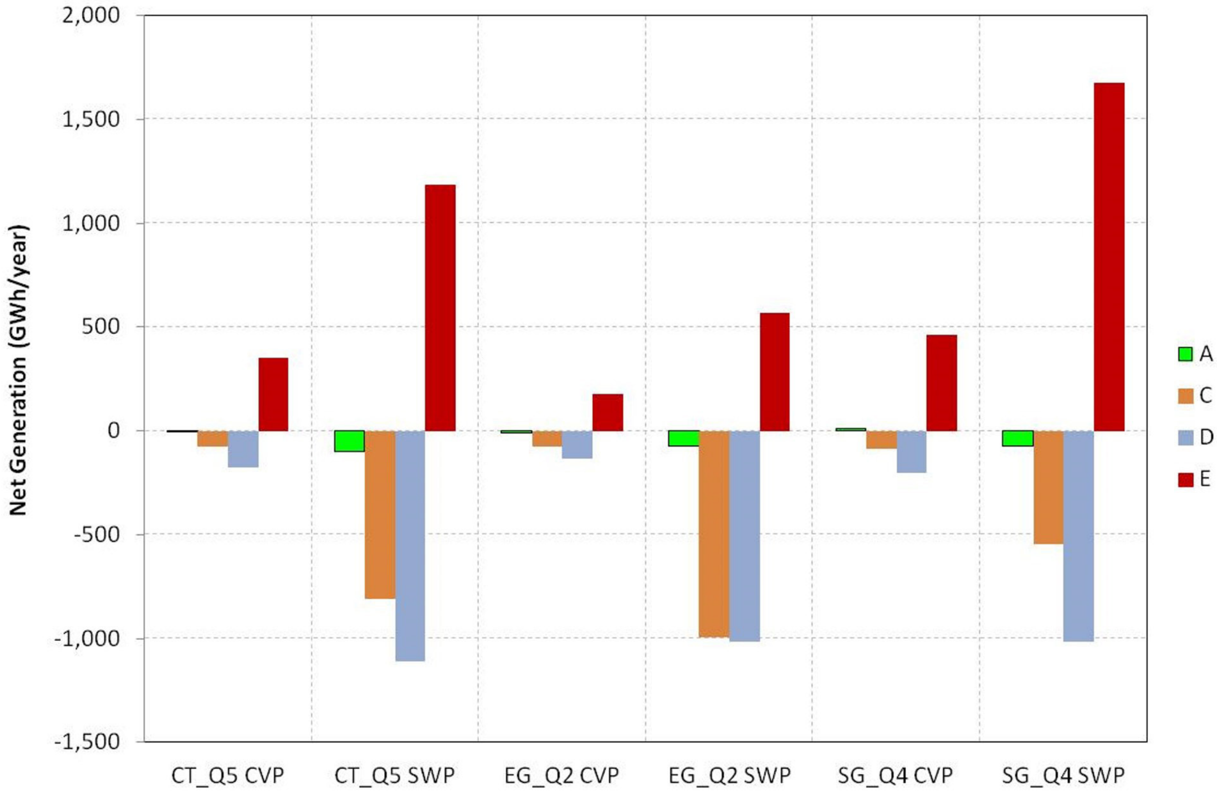

Figure 8-13. Change in Average Annual Net Hydropower Generation for CVP and SWP Facilities by Portfolio Relative to the Twenty-First Century Baseline Simulations

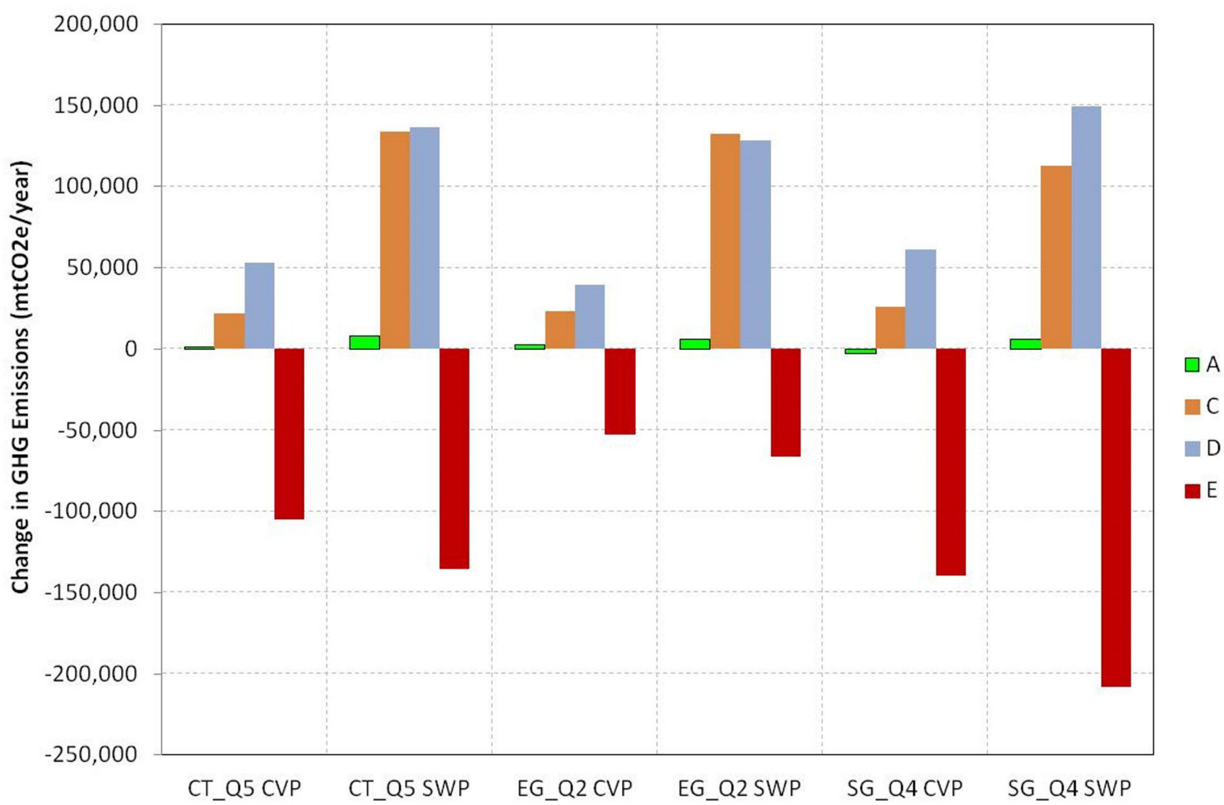

Figure 8-14. Change in Average Annual Greenhouse Gas Emissions for CVP and SWP Facilities by Portfolio Relative to the Twenty-First Century Baseline Simulations

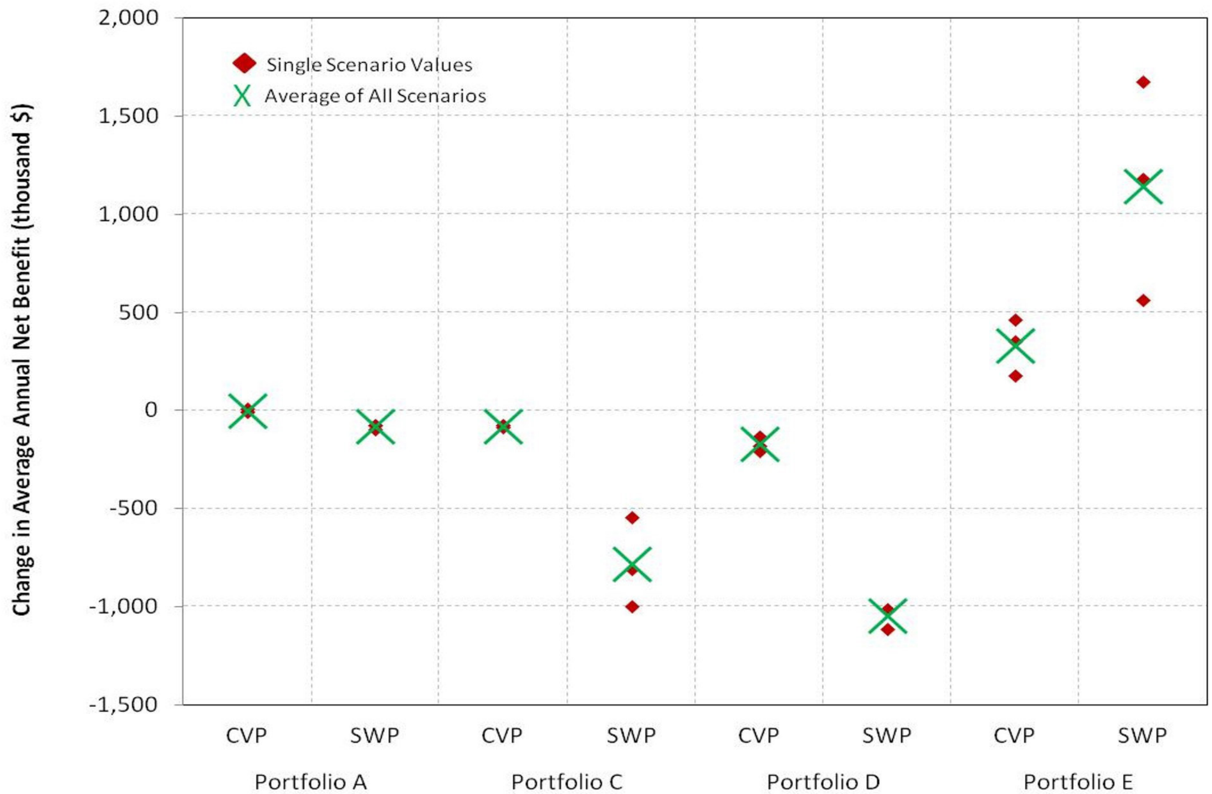

Figure 8-15. Distribution across Socioeconomic-Climate Scenarios of Change in Average Annual Net Hydropower Generation in CVP and SWP Facilities in Each Portfolio Relative to the Baseline

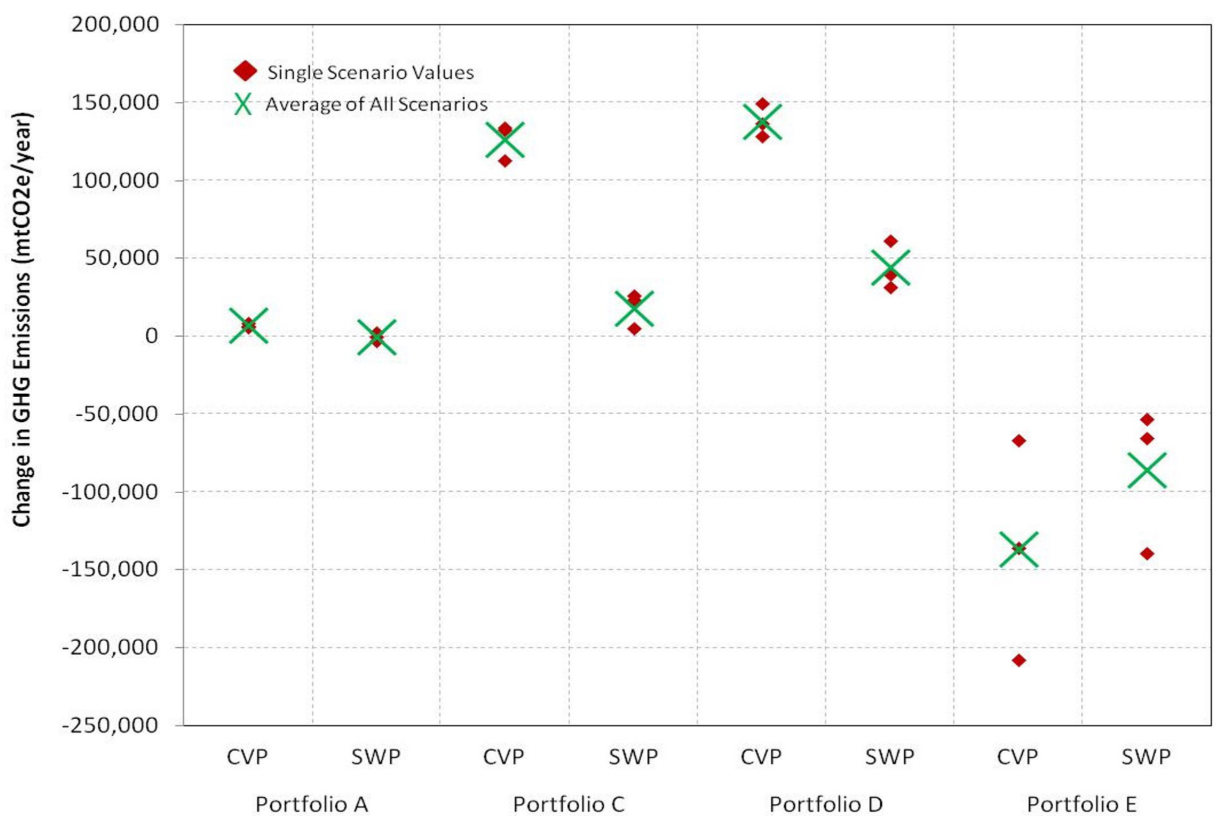

Figure 8-16. Distribution across Socioeconomic-Climate Scenarios of Change in Average Annual Greenhouse Gas Emissions in CVP and SWP Facilities in Each Portfolio Relative to the Baseline

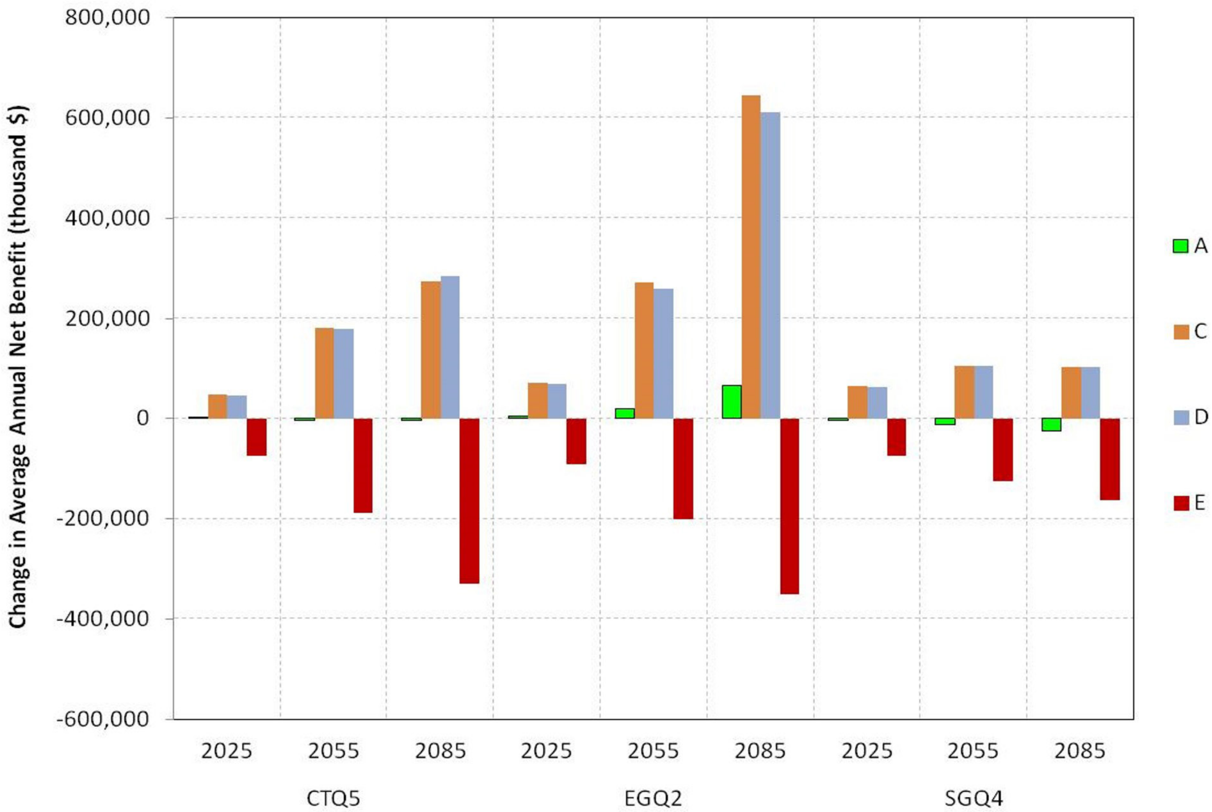

Figure 8-17. Change in Average Annual Agricultural and Urban Economic Benefits in the CVP Service Area by Portfolio Relative to the Twenty-First Century Baseline Simulations

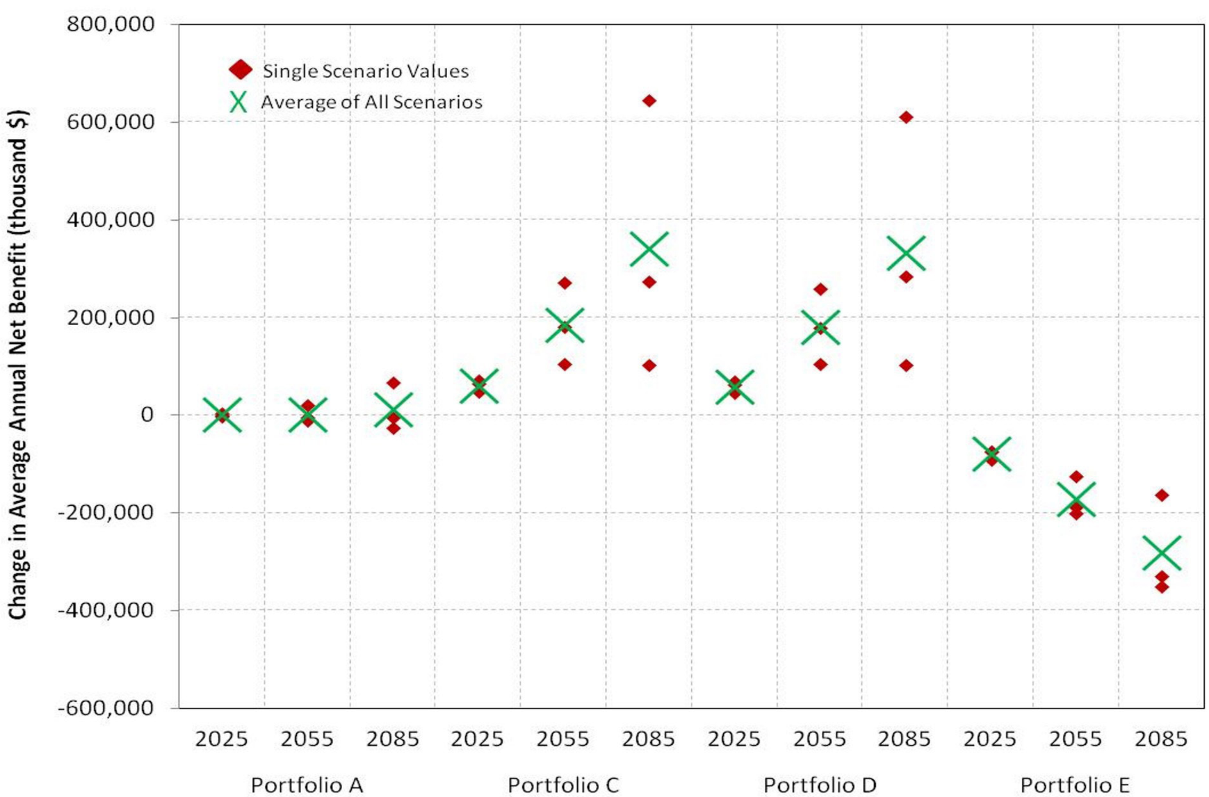

Figure 8-18. Changes across Socioeconomic-Climate Scenarios in Average Annual Agricultural and Urban Economic Net Benefits in the CVP Service Area by Portfolio Relative to the Twenty First Century Baseline Simulations

Portfolios C and D had increases in economic benefits that increased as the simulations moved farther into the twenty-first century. However, there was also greater uncertainty across the scenarios later in the century, indicating increasing uncertainty in potential future benefits. By contrast, Portfolio E showed reductions in economic benefits that also increased as the simulations advanced farther into the twenty-first century. However, the range of potential economic changes for Portfolio E was smaller than in Portfolios C and D, indicating less uncertainty in potential future changes.

8.8 Summary of Results

The results of portfolio performance assessments relative to the twenty-first century Baseline simulations and tradeoff analyses for the four portfolios evaluated in the CVP IRP study are summarized below for the CVP Service Area. Unmet demands, Delta exports, and Delta outflow were evaluated across the full range of the 18 socioeconomic-climate scenarios; whereas, the other performance metrics were only assessed across a range of three future socioeconomic-climate scenarios. It also should be noted that other potentially significant impacts such as the costs of implementing these portfolios were not evaluated.

Portfolio A: Aggressive Local Actions

- Reductions in Unmet Demands – provides the largest reductions in unmet demands among the portfolios averaging 1,061 TAF/year and ranging from 574 to 1,737 TAF/year.
- Delta Exports and Outflows – small to modest increases in Delta exports, averaging 56 TAF/year and ranging from 22 to 117 TAF/year, and small to modest increases in Delta outflows averaging 158 TAF/year and ranging from 29 to 245 TAF/year.
- Delta Salinity – slight changes in the Delta X2 position averaging -0.2 km and ranging from -0.3 to +0.1 km.
- Water Temperature – slight decreases in water temperature in both the Sacramento River at Jelly's Ferry averaging 0.1°F ranging from 0.0 to 0.2 F and in San Joaquin River at Gravelly Ford averaging 0.15°F and ranging from 0.10 to 0.18°F.
- Net Hydropower and GHG Emissions – slight reductions in net hydropower generation for the combined CVP-SWP system averaging 83 GWh/year ranging from 63 to 106 GWh/year, and slight increases in GHG emissions for the combined CVP-SWP system averaging 7,000 mTCO2e/year ranging from 3,000 to 11,000 mTCO2e/year.
- Economics – small net economic changes with an average benefit of $13 million/year in 2085, but ranging in 2085 from a cost of $25 million/ year to a benefit of $67 million/year.

Portfolio C: Delta Conveyance and North-of-Delta Storage

- Reductions in Unmet Demands – reductions in unmet demands averaging 795 TAF/year and ranging from 376 to 1,233 TAF/year.
- Delta Exports and Outflows –increases in Delta exports averaging 1,165 TAF/year and ranging from 940 to 1,384 TAF/year, and decreases in Delta outflows averaging 1,114 TAF/year and ranging from 867 to 1,319 TAF/year.
- Delta Salinity – moderate increases in the Delta X2 position averaging 1.7 km and ranging from 1.4 to 2.0 km.
- Water Temperature – slight to moderate decreases in water temperature in the Sacramento River at Jelly's Ferry averaging 0.5°F and ranging from 0.2 to 0.8°F, and very slight decreases in San Joaquin River at Gravelly Ford averaging 0.05°F and ranging from 0.03 to 0.06°F.
- Net Hydropower and GHG Emissions – decreases in net hydropower generation for the combined CVP-SWP system averaging 861 GWh/year and ranging from 617 to 1,083 GWh/year, and increases in GHG emissions for the combined CVP-SWP system averaging 144,000 mTCO2e/year and ranging from 118,000 to 160,000 mTCO2e/year.
- Economics – net economic benefits averaging $341 million/year in 2085 and ranging from $104 million/year to $646 million/year in 2085.

Portfolio D: Delta Conveyance and South-of-Delta Storage

- Reductions in Unmet Demands – reductions in unmet demands averaging 713 TAF/year and ranging from 383 to 1,024 TAF/year.
- Delta Exports and Outflows – increases in Delta exports averaging 1,235 TAF/year and ranging from 897 to 1,459 TAF/year, and decreases in Delta outflows averaging 1,114 TAF/year and ranging from 794 to 1,329 TAF/year.
- Delta Salinity – moderate increases in the Delta X2 position averaging 1.7 km and ranging from 1.5 to 1.9 km.
- Water Temperature – slight decreases in water temperature in both the Sacramento River at Jelly's Ferry averaging 0.1°F and ranging from 0 to 0.2°F, and very slight decreases in San Joaquin River at Gravelly Ford averaging 0.05°F and ranging from 0.03 to 0.06°F.
- Net Hydropower and GHG Emissions – decreases in net hydropower generation for the combined CVP-SWP system averaging 1,200 GWh/year and ranging from 1,100 to 1,300 GWh/year, and increases in GHG emissions for the combined CVP-SWP system averaging 182,000 mTCO2e/year and ranging from 160,000 to 211,000 mTCO2e/year.
- Economics – net economic benefits averaging $333 million/year in 2085 and ranging from $104 million/year to $612 million/year in 2085.

Portfolio E: Aggressive Local Actions, Enhanced Environmental Flows, and North-of-Delta Storage

- Reductions in Unmet Demands – reductions in unmet demands averaging 865 TAF/year and ranging from 453 to 1,471 TAF/year.
- Delta Exports and Outflows –decreases in Delta exports averaging 744 TAF/year and ranging from 389 to 952 TAF/year, and increases in Delta outflows averaging 1,022 TAF/year and ranging from 646 to 1,226 TAF/year.
- Delta Salinity – decreases in the Delta X2 position averaging 2.5 km and ranging from 2.2 to 3.0 km.
- Water Temperature – slight to moderate increases in water temperature in the Sacramento River at Jelly's Ferry averaging 0.3°F and ranging from 0.2 to 0.5°F, and slight decreases in San Joaquin River at Gravelly Ford averaging 0.15°F and ranging from 0.10 to 0.18°F.
- Net Hydropower and GHG Emissions – increases in net hydropower generation for the combined CVP-SWP system averaging 1,500 GWh/year and ranging from 700 to 2,100 GWh/year, and decreases in GHG emissions for the combined CVP-SWP system averaging 222,000 mTCO2e/year and ranging from 119,000 to 347,000 mTCO2e/year.
- Economics – net economic costs averaging $285 million/year in 2085 and ranging from $162 million/year to $350 million/year in 2085.

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Table 9-1. Reference Information for Citations on Figure 3-18

Figure 3-18 Citation	Complete Reference
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APPENDIX A - CALLITE BASELINE ASSUMPTION FOR THE CVP INTEGRATED RESOURCE PLAN

Table 1. CALSIM II and CalLite Modeling Assumptions

Parameter Category/Study	CVP IRP CalLite Baseline Assumption
General	
Planning horizon	Transient simulation from 2012-2099
Demarcation date[a]	February 2009 (but with June 2009 NMFS BO included)
Period of simulation	88 years (Water Years 2012-2099)
Hydrology	
Inflows/supplies	Future climate-based hydrology determined by WEAP
Level of development	Transient assumptions from 2012-2099
Demands, Water Rights, CVP-SWP Contracts	
Sacramento River Region (excluding American River)	
CVP[b]	WEAP-based, limited by contract amounts
SWP (FRSA)[c]	WEAP-based, limited by contract amounts
Non-project	WEAP-based, limited by water rights and SWRCB decisions for existing facilities
Antioch	Pre-1914 water right
Federal refuges[d]	Firm Level 2 water needs
Sacramento River Region - American River[e]	
Water rights	Year 2025, full water rights
CVP	Year 2025, full water rights, including Freeport Regional Water Project
San Joaquin River Region[f]	
Friant Unit	Limited by contract amounts, based on current allocation policy
Lower Basin	WEAP-based, based on district-level operations and constraints
Stanislaus River[g]	WEAP-based, Revised Operations Plan[m] and NFMS BO (June 2009) Actions III.1.2 and III.1.3[o]
San Francisco Bay, Central Coast, Tulare Lake, and South Coast Regions (CVP-SWP project facilities)	
CVP[b]	Demand based on contracts amounts
CCWD[h]	195 TAF/yr CVP contract supply and water rights
SWP[c,i]	Demand based on full Table A amounts
Article 56	Based on 2001-2008 contractor requests
Article 21	MWD demand up to 200 TAF/month from December to March subject to conveyance capacity, KCWA demand up to 180 TAF/month, and other contractor demands up to 34 TAF/month in all months, subject to conveyance capacity

Parameter Category/Study	CVP IRP CalLite Baseline Assumption
NBA	77 TAF/yr demand under SWP contracts, up to 43.7 cfs of excess flow under Fairfield, Vacaville, and Benicia Settlement Agreement
Federal refuges[d]	Firm Level 2 water needs
Facilities	
Systemwide	
Systemwide	Existing facilities
Isolated facility	None
Sacramento River Region	
Shasta Lake	Existing, 4,552 TAF capacity
Red Bluff Diversion Dam	Diversion dam operated with gates out all year, NMFS BO (June 2009) Action I.3.1v; assume permanent facilities in place
Colusa Basin	Existing conveyance and storage facilities
Upper American River[e,j]	PCWA American River Pump Station
Lower Sacramento River	Freeport Regional Water Project
Freemont Weir/Yolo Bypass	Existing weir
San Joaquin River Region	
Millerton Lake (Friant Dam)	Existing, 520-TAF capacity
Lower San Joaquin River	City of Stockton Delta Water Supply Project, 30-mgd capacity
Delta Region	
SWP Banks Pumping Plant (South Delta)	Physical capacity is 10,300 cfs but 6,680-cfs permitted capacity in all months up to 8,500 cfs during Dec 15 – March 15 depending on Vernalis flow conditions[k]
CVP C.W. Bill Jones Pumping Plant (Tracy PP)	Permit capacity is 4,600 cfs in all months (allowed for by the Delta-Mendota Canal–California Aqueduct Intertie)
Upper Delta-Mendota Canal capacity	Not simulated in CalLite
CCWD intakes	Los Vaqueros existing storage capacity, 100 TAF, existing pump locations, AIP included[l]
San Francisco Bay Region	
SBA	Not simulated in CalLite
South Coast Region	
California Aqueduct East Branch	Not simulated in CalLite
Regulatory Standards	
North Coast Region	
Trinity River	
Minimum flow below Lewiston Dam	Trinity EIS Preferred Alternative (369-815 TAF/yr)
Trinity Reservoir end-of-September minimum storage	Not simulated in CalLite
Sacramento River Region	
Clear Creek	
Minimum flow below Whiskeytown Dam	Downstream water rights, 1963 Reclamation Proposal to USFWS and NPS, predetermined CVPIA 3406(b)(2) flows, and NMFS BO (June 2009) Action I.1.1v
Upper Sacramento River	
Shasta Lake end-of-September minimum storage	Not simulated in CalLite
Minimum flow below Keswick Dam	SWRCB WR 90-5 temperature control, predetermined CVPIA 3406(b)(2) flows, and NMFS BO (June 2009) Action I.2.2v

Parameter Category/Study	CVP IRP CalLite Baseline Assumption
Feather River	
Minimum flow below Thermalito Diversion Dam	Not simulated in CalLite
Minimum flow below Thermalito Afterbay outlet	1983 DWR, CDFW Agreement (750-1,700 cfs)
Yuba River	
Minimum flow below Daguerre Point Dam	Minimum flows from Yuba River Model
American River	
Minimum flow below Nimbus Dam	American River Flow Management as required by NMFS BO (June 2009) Action II.1[o]
Minimum flow at H Street Bridge	SWRCB D-893
Lower Sacramento River	
Minimum flow at Freeport	None
North Delta Diversion Bypass flow	None None None
Minimum flow near Rio Vista	SWRCB D-1641
San Joaquin River Region	
Mokelumne River	
Minimum flow below Camanche Dam	Not simulated in CalLite
Minimum flow below Woodbridge Diversion Dam	Not simulated in CalLite
Stanislaus River	
Minimum flow below Goodwin Dam	1987 Reclamation, CDFW agreement, and flows required for NMFS BO (June 2009) Action III.1.2 and III.1.3[o]
Minimum dissolved oxygen Merced River	SWRCB D-1422
Minimum flow below Crocker-Huffman Diversion Dam	Davis-Grunsky (180-220 cfs, Nov-Mar), and Cowell Agreement
Minimum flow at Shaffer Bridge	FERC 2179 (25-100 cfs)
Tuolumne River	
Minimum flow at Lagrange Bridge	FERC 2299-024, 1995 (Settlement Agreement) (94-301 TAF/yr)
San Joaquin River	
San Joaquin River below Friant Dam/ Mendota Pool Maximum salinity near Vernalis	Water Year 2010 Interim Flows Project[n] SWRCB D-1641
Minimum flow near Vernalis	SWRCB D-1641 and NMFS BO (June 2009) Action IV.2.1[o]
Sacramento River–San Joaquin Delta Region	
Delta Outflow Index (Flow, NDOI)	SWRCB D-1641
Delta Outflow Index (Salinity, X2) - Spring	SWRCB D-1641
Delta Outflow (Salinity, X2) - Fall	USFWS BO (Dec 2008) Action 4 (Reservoir release cap for November is not implemented)
Delta Cross Channel gate operation	SRWCB D-1641 with additional days closed from Oct 1 – Jan 31 based on NMFS BO (June 2009) Action IV.1.2o (closed during flushing flows from Oct 1 – Dec 14 unless adverse water quality conditions); NMFS BO requirement is modeled by a month by WY Type table

Parameter Category/Study	CVP IRP CalLite Baseline Assumption
South Delta exports (Jones PP and Banks PP)	SWRCB D-1641, Vernalis flow-based export limits April 1 – May 31 as required by NMFS BO (June 2009) Action IV.2.1[o]
Combined flow in OMR	USFWS BO (Dec 2008) Actions 1 through 3 and NMFS BO (June 2009) Action IV.2.3o; USFWS BO requirement is modeled by a month by WYType table
Delta water quality	SWRCB D-1641
Operations Criteria: River-Specific	
Sacramento River Region	
Upper Sacramento River: Flow objective for navigation (Wilkins Slough)	NMFS BO (June 2009) Action I.4o; 3,500 – 5,000 cfs based on CVP water supply condition
American River: Folsom Dam flood control	Variable 400/670 flood control diagram (without outlet modifications)
Feather River: Flow at mouth of Feather River (above Verona)	Maintain CDFW/DWR flow target of 2,800 cfs for April – Sept dependent on Oroville inflow and FRSA allocation
San Joaquin River Region	
Stanislaus River: Flow below Goodwin Dam[i]	Revised Operations Planm and NMFS BO (June 2009) Action III.1.2 and III.1.3[o]
San Joaquin River: Salinity at Vernalis	Grasslands Bypass Project (full implementation)
Operations Criteria: Systemwide	
North & South Delta Intakes Operation Criteria	
Water quality and residence time	None
CVP Water Allocation	
Settlement / Exchange	100% (75% in Shasta critical years)
Refuges	100% (75% in Shasta critical years)
Agriculture Service	100%-0% based on supply, South-of-Delta allocations are additionally limited due to SWRCB D-1641, USFWS BO (Dec 2008), and NMFS BO (June 2009) export restrictions[o]
Municipal & Industrial Service	100%-50% based on supply, South-of-Delta allocations are additionally limited due to SWRCB D-1641, USFWS BO (Dec 2008), and NMFS BO (June 2009) export restrictions[o]
SWP Water Allocation	
North of Delta (FRSA)	Contract-specific
South of Delta (including North Bay Aqueduct)	Based on supply; equal prioritization between Ag and M&I based on Monterey Agreement; allocations are additionally limited due to SWRCB D-1641, USFWS BO (Dec 2008), and NMFS BO (June 2009) export restrictions[o]
CVP-SWP Coordinated Operations	
Sharing of responsibility for in-basin use	1986 Coordinated Operations Agreement (FRWP EBMUD and two-thirds of the North Bay Aqueduct diversions considered as Delta Export; one-third of the North Bay Aqueduct diversion considered as in-basin-use)
Sharing of surplus flows	1986 Coordinated Operations Agreement
Sharing of total allowable export capacity for project-specific priority pumping	Equal sharing of export capacity under SWRCB D-1641, USFWS BO (Dec 2008), and NMFS BO (June 2009) export restrictions[o]
Water transfers	Not simulated in CalLite
Sharing of export capacity for lesser priority and wheeling-related pumping	CALFED ROD defined Joint Point of Diversion (JPOD); Cross Valley Canal wheeling is not simulated in CalLite
San Luis Reservoir	San Luis Reservoir is allowed to operate to a minimum storage of 100 TAF

Parameter Category/Study	CVP IRP CalLite Baseline Assumption
CVPIA 3406(b)(2)	
Policy Decision	Not simulated in CalLite
Allocation	Not simulated in CalLite
Actions	Not simulated in CalLite
Accounting	Not simulated in CalLite
Water Management Actions	
Water Transfer Supplies (long-term programs)	
Lower Yuba River Accord	Not simulated in CalLite
Phase 8	Not simulated in CalLite
Water Transfers (short-term or temporary programs)	
Sacramento Valley acquisitions conveyed through Banks PP	Not simulated in CalLite

CalSIM Notes:

[a] These assumptions have been developed under the direction of the DWR and Reclamation management team for the BDCP HCP and EIR/EIS.

[b] CVP contract amounts have been updated according to existing and amended contracts as appropriate.

[c] SWP contract amounts have been updated as appropriate based on recent Table A transfers/agreements.

[d] Water needs for federal refuges have been reviewed and updated as appropriate. Refuge Level 4 (and incremental Level 4) water is not analyzed.

[e] The Sacramento Area Water Forum Agreement, its dry-year diversion reductions, Middle Fork Project operations, and “mitigation” water are not included.

[f] The CalLite representation of the San Joaquin River reflects the CALSIM II implementation of the 2030 level of development representation of the San Joaquin River Basin.

[g] The CalLite model representation for the Stanislaus River does not necessarily represent Reclamation’s current or future operational policies. A suitable plan for supporting flows has not been developed for NMFS BO (June 2009) Action 3.1.3.

[h] The actual amount diverted is operated in conjunction with supplies from the Los Vaqueros project. The existing Los Vaqueros storage capacity is 100 TAF. Associated water rights for Delta excess flows are included.

[i] It is assumed that SWP Contractors can take delivery of all Table A allocations and Article 21 supplies. Article 56 provisions are assumed and allow for SWP Contractors to manage storage and delivery conditions such that full Table A allocations can be delivered. Article 21 deliveries are limited in wet years under the assumption that demand is decreased in these conditions. Article 21 deliveries for the NBA are dependent on excess conditions only, all other Article 21 deliveries also require that San Luis Reservoir be at capacity and that Banks PP and the California Aqueduct have available capacity to divert from the Delta for direct delivery.

[j] PCWA American River pumping facility upstream of Folsom Lake is included. The diversion is assumed to be 35.5 TAF/yr.

[k] Current ACOE permit for Banks PP allows for an average diversion rate of 6,680 cfs in all months. Diversion rate can increase up to one-third of the rate of San Joaquin River flow at Vernalis during Dec 15 – March 15 up to a maximum diversion of 8,500 cfs, if Vernalis flow exceeds 1,000 cfs.

[l] The CCWD AIP, an intake at Victoria Canal, which operates as an alternate Delta diversion for Los Vaqueros Reservoir. This assumption is consistent with the future no-project condition defined by the Los Vaqueros Enlargement study team.

[m] The model operates the Stanislaus River using a 1997 Interim Plan of Operation-like structure, i.e., allocating water for SEWD and CSJWCD, Vernalis water quality dilution and Vernalis D-1641 flow requirements based on the New Melones Index. OID and SSJID allocations are based on their 1988 agreement and Ripon DO requirements are represented by a static set of minimum instream flow requirements during June thru Sept. Instream flow requirements for fish below Goodwin are based on NMFS BO Action III.1.2. NMFS BO Action IV.2.1’s flow component is not assumed to be in effect.

[n] SJR Restoration Water Year 2010 Interim Flows Project are assumed, but are not input into the models; operation not regularly defined at this time.

[o] In cooperation with Reclamation, National Marine Fisheries Service, U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife, the California Department of Water Resources has developed assumptions for implementation of the USFWS BO (Dec 15, 2008) and NMFS BO (June 4, 2009) in CALSIM II.

ACOE	=	Army Corps of Engineers
Ag	=	agriculture
AIP	=	Alternative Intake Project
BDCP	=	Bay Delta Conservation Plan
BO	=	biological opinion
CCWD	=	Contra Costa Water District
CDFW	=	California Department of Fish and Wildlife
cfs	=	cubic foot (feet) per second
CSJWCD	=	Central San Joaquin Water Conservation District
CVP	=	Central Valley Project
CVPIA	=	Central Valley Project Improvement Act
DO	=	dissolved oxygen
DWR	=	California Department of Water Resources
EBMUD	=	East Bay Municipal Utility District
EIR	=	environmental impact report
EIS	=	environmental impact statement
FERC	=	Federal Energy Regulatory Commission
FRSA	=	Feather River Service Area
HCP	=	Habitat Conservation Plan
IRP	=	Installation Restoration Program
KCWA	=	Kern County Water Agency
M&I	=	municipal and industrial
mgd	=	million gallons per day
MWD	=	Metropolitan Water District of Southern California
NBA	=	North Bay Aqueduct
NDOI	=	Net Delta Outflow Index
NMFS	=	National Marine Fisheries Service
NPS	=	National Park Service
OID	=	Oakdale Irrigation District
OMR	=	Old and Middle River
PCWA	=	Placer County Water Agency
PP	=	Pumping Plant
Reclamation	=	Bureau of Reclamation
SBA	=	South Bay Aqueduct
SEWD	=	Stockton East Water District
SJR	=	San Joaquin River
SSJID	=	South San Joaquin Irrigation District
SWP	=	State Water Project
SWRCB	=	State Water Resources Control Board
TAF	=	thousand acre-feet
USFWS	=	U.S. Fish and Wildlife Service
WEAP	=	Water Evaluation and Planning (model)
yr	=	year

References:

United States Fish and Wildlife Service (USFWS). 2008. Formal Endangered Species Act Consultation on the Proposed Coordinated Operations of the Central Valley

Project (CVP) and State Water Project (SWP). December 2008.

National Marine Fisheries Service (NMFS). 2009. Biological and conference opinion on the long-term operations of the Central Valley Project and State Water Project. June 2009.